ALLYL CHLORIDE

Allyl chloride is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 107-05-1 $CH_2=CHCH_2Cl$

Molecular Formula: C_3H_5Cl

Allyl chloride is a colorless liquid with an unpleasant, pungent odor. It is slightly soluble in water and miscible with alcohol, chloroform, ether, and petroleum ether (Sax, 1987).

Physical Properties of Allyl Chloride

Synonyms: 3-chloro-1-propene; 3-chloropropylene; Chlorallylene

Molecular Weight:	76.53
Boiling Point:	45 ^oC
Melting Point:	-134.5 ^oC
Flash Point:	-31 ^oC(-25 ^oF) closed cup
Vapor Density:	2.64 (air = 1)
Density/Specific Gravity:	0.938 at 20/4 ^oC (water = 1)
Vapor Pressure:	368 mm Hg at 25 ^oC
Log Octanol/Water Partition Coefficient:	-0.24
Conversion Factor:	1 ppm = 3.13 mg/m^3

(HSDB, 1991; Merck, 1983)

SOURCES AND EMISSIONS

A. Sources

Allyl chloride is used as a chemical intermediate in the manufacture of pharmaceuticals, varnishes, epoxy resins, adhesives, plastics, gylcerol, and insecticides (ARB, 1995a). The primary stationary sources that have reported emissions of allyl chloride in California are automotive repair shops, educational services, and metal industries (ARB, 1997b).

B. Emissions

The total emissions of allyl chloride from stationary sources in California are estimated to be at least 270 pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

Allyl chloride has not been reported to occur in nature (HSDB, 1991).

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of allyl chloride. However, the United States Environmental Protection Agency (U.S. EPA) has compiled data from several U.S. cities that reported mean concentrations of less than 16 to 19 nanograms per cubic meter or 0.005 to 0.006 parts per billion in 1980 to 1981 (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

Data on indoor concentrations of allyl chloride are extremely limited. During June of 1990, 125 households in Woodland, California, were monitored for a variety of toxic air contaminants. Sampling included allyl chloride; however, it was not present in measurable concentrations in any of the samples. The method's quantifiable limit was 0.6 micrograms per cubic meter ($\mu g/m^3$). Allyl chloride had not been monitored in similar studies. As of 1991, no emission data were available for allyl chloride from indoor sources (Sheldon et al, 1992). Product types which may be possible sources of allyl chloride include some varnishes and adhesives (Hodgson and Wooley, 1991).

ATMOSPHERIC PERSISTENCE

The dominant tropospheric removal process for allyl chloride is by reaction with photochemically-produced hydroxyl radicals. The calculated half-life of acrylonitrile due to its gas phase reaction with hydroxyl radicals is estimated to be 14 hours (Atkinson, 1995). The products of its reaction with the hydroxyl radical include formaldehyde, chloro-peroxy acetyl nitrate, chloroacetaldehyde, glycolaldehyde, formyl chloride, and 1,3-dichloroacetone (Kao, 1994).

AB 2588 RISK ASSESSMENT INFORMATION

Although allyl chloride is reported as being emitted in California from stationary sources, no health values (cancer or non-cancer) are listed in the California Air Pollution Control Officers Association Air Toxics “Hot Spots” Program Revised 1992 Risk Assessment Guidelines for use in risk assessments (CAPCOA, 1993).

HEALTH EFFECTS

Probable routes of human exposure to allyl chloride are inhalation and dermal contact.

Non-Cancer: Allyl chloride vapor is a severe irritant of the respiratory tract, eyes, and skin. Chronic exposure to allyl chloride in humans causes injury to the central nervous and respiratory

systems. Peripheral neuropathy, and mild hepatotoxicity and nephrotoxicity have also occurred in chronically exposed workers (HSDB, 1991).

The U.S. EPA has established a Reference Concentration (RfC) for allyl chloride of 0.001 milligrams per cubic meter, based on functional and histological peripheral neurotoxicity in rabbits. The U.S. EPA estimates that inhalation of this concentration, over an entire lifetime, would not likely result in the occurrence of chronic, non-cancer effects. The U.S. EPA has not established an oral Reference Dose (RfD) (U.S. EPA, 1994a).

In one rabbit study, decreased maternal weight gain was observed, and rats injected with allyl chloride had increased maternal heart, liver, spleen, and kidney weights (U.S. EPA, 1994a).

Cancer: No human cancer data were found for allyl chloride. Limited data from animal studies indicated that exposure to allyl chloride by gavage resulted in an increase in the incidence of a rare forestomach tumor. Allyl chloride is an alkylating agent and structurally related to probable human carcinogens (U.S. EPA, 1994a).

The U.S. EPA has classified allyl chloride in Group C: Possible human carcinogen (U.S. EPA, 1994a). The International Agency for Research on Cancer has classified allyl chloride in Group 3: Not classifiable as a carcinogen (IARC, 1987a).

The State of California has determined under Proposition 65 that allyl chloride is a carcinogen (CCR, 1996). The inhalation potency factor that has been used as a basis for regulatory action in California is 6×10^{-6} (microgram per cubic meter)$^{-1}$ (OEHHA, 1994). In other words, the potential excess cancer risk for a person exposed over a lifetime to 1 $\mu g/m^3$ of allyl chloride is estimated to be no greater than 6 in 1 million. The oral potency factor that has been used as a basis for regulatory action in California is 2.1×10^{-2} (milligram per kilogram per day)$^{-1}$ (OEHHA, 1994).